THE MAGAZINE OF METAL COMPONENT DESIGN AND PRODUCTION

NOVEMBER 1980

Precision Metal

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ANNUAL CHECKUP OF THE PM INDUSTRIES

STATE OF THE INDUSTRY 1980

Die casting cost analysis with a minicomputer

Trends in forging grade steel production

Finishing equipment and materials

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FEATURES

25 **Forging quality steel: Update**
Forging steel did not improve much technologically this year, but inspection/conditioning has given mills a better product.

31 **Computer is the die caster's cost estimate**
A program available for a low-cost minicomputer makes die casting cost analysis faster and more accurate.

35 **Finishing and machining equipment & supplies**
Get literature free on finishing and machining equipment and supplies as easy as circling a number.

41 **Dual metal strip trims blanking costs**
Electron beam welded copper/silver strip simplifies production and cuts costs for blanked switch contact frames.

45 State of the Industry 1980
This year's report is the most comprehensive yet on the health of the precision metal industries. Get the information you need on production, installed capacity and plans to buy in your industry.

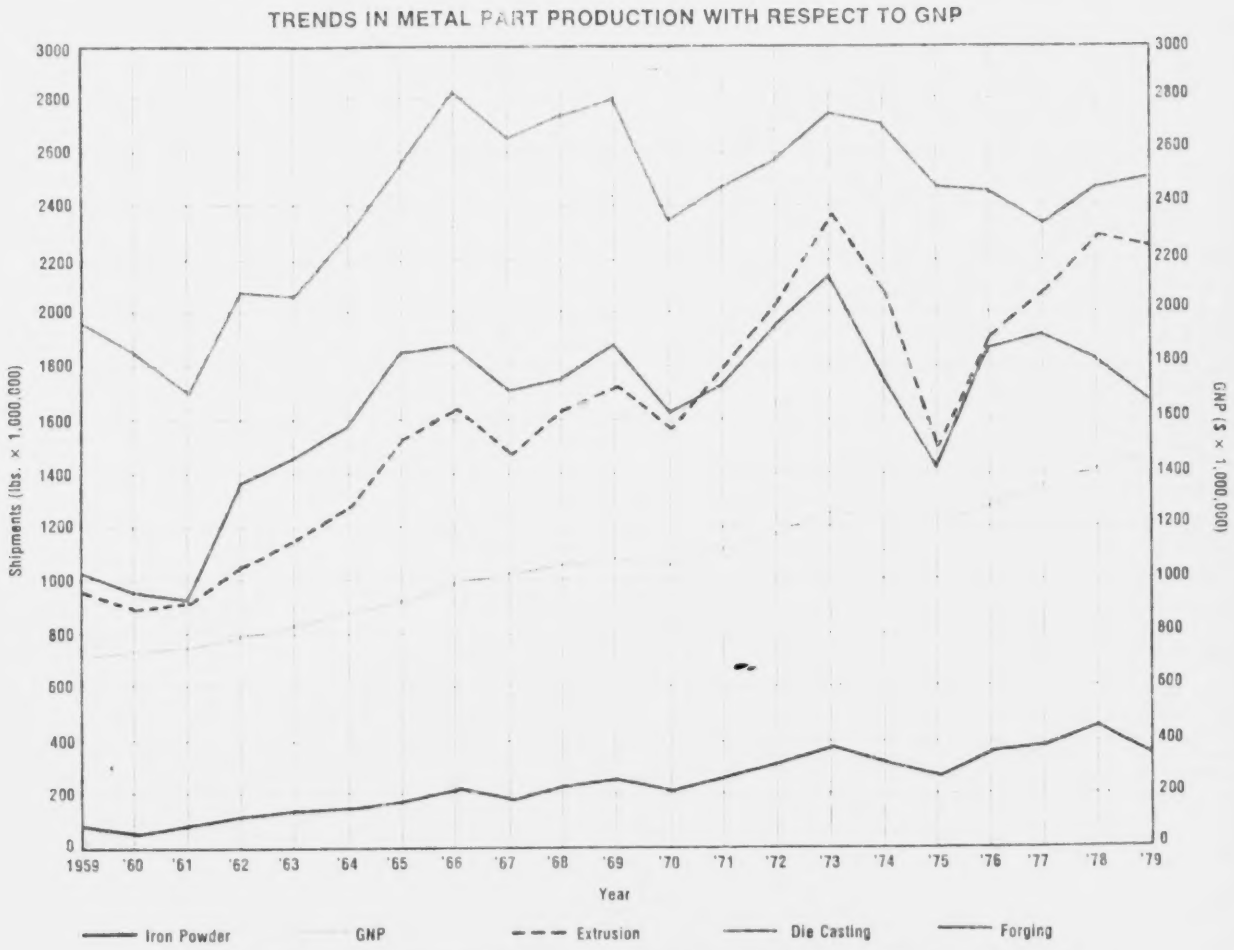
DEPARTMENTS

PM DATA BANK
8 Metals Newsfront
18 Association News
22 Coming Events
74 People in the News
77 Technical Literature
99 Product Information
21 Precisely Speaking
108 Management Leisure Time
115 Opportunities
116 Advertisers Index

Cover photo by Larry Davis.

STATE OF THE INDUSTRY 1980

By James E. Billingsley, assistant editor



While precision metal part shipments vary considerably, the general trends follow the Gross National Product. Roll forming and investment casting were not included because of the lack of historical data.

The precision metal industries comprise a major segment of today's manufacturing capacity. Precision metal parts are specified for everything from the most common household appliance to the most sophisticated aerospace product.

All of our industries are effected by general business conditions, as demonstrated by the GNP chart on the previous page. Although certain industries are hit harder by slowdowns in specific parts of the economy such as the automotive, construction and aerospace industries, we believe the trend to follow the GNP will continue.

But this cannot happen automatically. The conditions of the 1980s will present a distinct challenge to the precision metal industries. The business will be there, but whether any specific plant or industry will be able to take it on will depend largely on how that industry meets the challenges of increasing energy and materials costs, the need for improved productivity and general inflation. This survey is designed to help management and production executives in the precision metal industries prepare for these challenges.

Most of the data contained in this report are based on information obtained from our own surveys of the precision metal industries. These surveys were conducted by sending questionnaires to selected management and production executives in the die casting, extrusion, forging, investment casting, powder metal and roll forming industries. Answers to the questions on the surveys were tabulated and are presented in this report along with our own industry projections.

It was assumed that all questionnaires were complete with regard to capital equipment. Thus, for example, if the question on cold headers in the forging questionnaire was left blank, we assumed that no cold headers were installed in that plant.

The returns for expendable supplies were clearly not complete, as many plants may not keep accurate records of such things. The percentage of plants in an industry using a particular type of expendable supply was estimated from other industry information and our knowledge of that industry.

All plant averages for installed capital equipment are based on total responses for the industry under consideration, not on the number of plants answering a particular question. Plant averages for expendable supplies were based on the number of responses for a particular question, except forging, where the averages were computed by dividing out projected industry total by our assumed number of forging plants.

We believe an important indicator of future business trends is what the people in the industry itself view it to be. On each industry questionnaire, we asked respondents their opinion as to whether they expected next year's business to be up, down or the same in appropriate product categories.

Much die casting production goes into automobiles and consumer products. Die casters must be confident that these key industries will pick up in 1981, as more than half of the die casters surveyed believe 1981 tonnage will be up from 1980 levels.

The extrusion industry has been affected by slowdowns in building and construction and consumer durables, but has maintained an essentially constant total tonnage for extruded shapes. Still, three quarters of extruders surveyed believe 1981 will bring greater shipments.

The forging industry, which serves diverse markets for structural parts in a wide range of aerospace, industrial and consumer products, is equally optimistic. Most forgers surveyed believe stainless steel shipments will be up, followed by aluminum and alloy steel. Even in the "Other" category, which would include titanium and other nonferrous alloys, 61% of forgers surveyed believe 1981 tonnage will increase.

When asked about the trend in 1981 shipments, investment casters unanimously indicated a belief that 1981 shipments will be up. Even projected total shipments for 1980 look good, with plusses in all metal categories except one. Copper investment castings are down 3.5%.

Powder metallurgy, with its inherent energy and material utilization efficiency, should have a good year in 1981. Nearly three quarters of P/M producers surveyed believe iron P/M, which is where most P/M tonnage is today, will be up in 1981.

Much roll forming output goes into construction/building products, transportation, furniture and office equipment, appliance and other industries. Our survey indicates that the roll forming industry can expect few surprises in 1981, with nearly all responding companies expecting 1981 to be about the same as 1980.

One final note. The editor wishes to thank Jamie Feldman, Penton/IPC artist, for the design and production of this section, and Michael Keating, Penton/IPC research, for gathering statistical information.

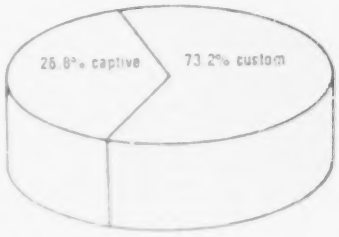
DIE CASTING

Questionnaires were sent to 788 production and management executives in the die casting industry. Useful responses were received from 19% of these, for a response rate of 24%. We have assumed a total of 1150 - 1200 die casting plants in the United States. Our projections for installed capital equipment were made by multiplying our respondents' totals by six and rounding.

According to our survey, the die casting industry in 1980 is predominately custom, with 73.2% of the plants surveyed custom and 26.8% captive. The average die casting plant is moderate in size, employing about 42 people.

A look at the 10-year trends in die casting shipments reveals that aluminum had held up quite well over the decade. The ups and downs of the economy have left their mark on yearly shipments of aluminum die castings, but the general trend still shows growth. Zinc die casting shipments, on the other hand, have declined steadily since 1976. Most of this decline has taken place in captive shipments. Probably the primary cause is the drive for automotive weight reduction, with conventional

CUSTOM OR CAPTIVE?
The respondents to our die casting survey were . . .



GEOGRAPHIC DISTRIBUTION

Top numbers indicate percentage of die casting plants in region. Bottom numbers indicate percentage of die casting users in region. Based on computer analysis of PRECISION METAL circulation.

SHIPMENT TRENDS

Metal	1980	1981		
		Increase	Decrease	About the Same
Aluminum	-21.1%	60.0	17.3	22.7
Zinc	-16.5%	40.2	23.0	36.8
Magnesium	+47.5%	71.4	0.0	28.6

1980 figures indicate respondents' expected increase or decrease. The 1981 figures represent the percentage of respondents expecting 1981 shipments to be greater, smaller or about the same as 1980 shipments.

DIE CASTING MACHINES — HOT CHAMBER

Locking force (tons)	Now installed			Plan to buy by end 1981		
	Respondents have	Average/ plant	Projected ind. total	Number of plants	Number of machines	Projected ind. total
less than 100	363	9	2,200	20	44	260
100-250	262	1.3	1,600	8	9	55
251-400	168	0.9	1,000	8	10	60
401-550	108	0.6	650	6	6	35
551-700	55	0.3	330	1	2	10
701-850	18	0.1	110	0	0	0
851-1000	5	0.0	30	0	0	0
over 1000	6	0.0	40	0	0	0
Total	985	5.1	5,900	38	71	430

DIE CASTING MACHINES—COLD CHAMBER

Locking force (tons)	Now installed			Plan to buy by end 1981		
	Respondents have	Average/ plant	Projected ind. total	Number of plants	Number of machines	Projected ind. total
less than 100	27	0.1	160	0	0	0
100-250	70	0.4	420	4	5	30
251-400	216	1.1	1,300	11	14	85
401-500	208	1.1	1,200	10	16	95
551-700	363	1.9	2,200	20	36	220
701-850	116	0.6	700	9	24	140
851-1000	45	0.2	270	2	6	35
1000 +	45	0.2	270	4	4	25
Total	1,090	5.6	6,500	47	105	630

FURNACES

Type	Now installed			Plan to buy by end 1981		
	Respondents have	Average/ plant	Projected ind. total	Number of plants	Number of machines	Projected ind. total
Breakdown						
Fuel-fired	478	2.5	2,900	30	42	250
Electric	109	0.6	650	7	12	70
Holding						
Fuel-fired	618	3.2	3,700	20	50	300
Electric	374	1.9	2,200	10	67	400

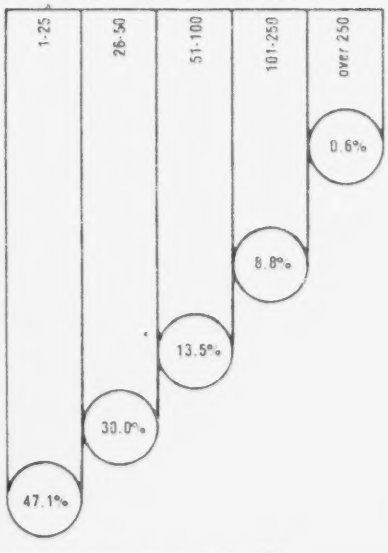
OTHER CAPITAL EQUIPMENT

Type	Now installed			Plan to buy by end 1981		
	Respondents have	Average/ plant	Projected ind. total	Number of plants	Number of machines	Projected ind. total
Casting conveyors	354	1.8	2,100	12	27	160
Scrap conveyors	180	0.9	1,100	11	17	100
Robots	124	0.6	740	31	38	230
Extractors	157	0.8	940	14	33	200
Duplicators	7	0.0	40	5	4	25
EDM	72	0.4	430	13	13	80
N.C. equipment	27	0.1	160	5	5	30
Automatic ladles	345	1.8	2,100	33	91	460
Automatic lubricators	675	3.5	4,100	31	84	500
Molten metal pumps	74	0.4	440	8	18	110

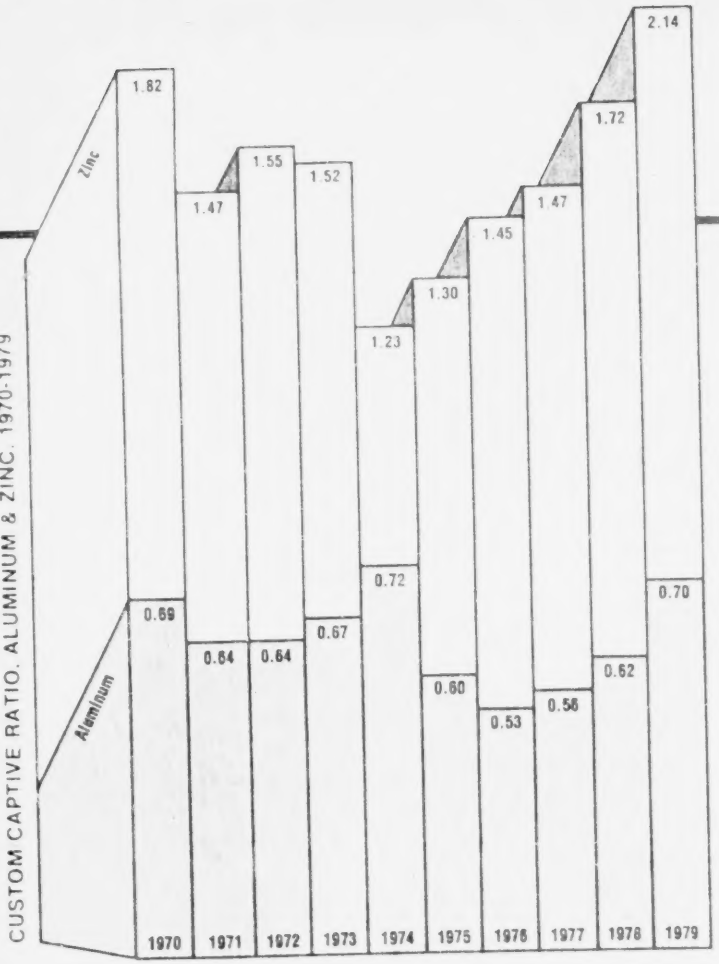
CONTROLS

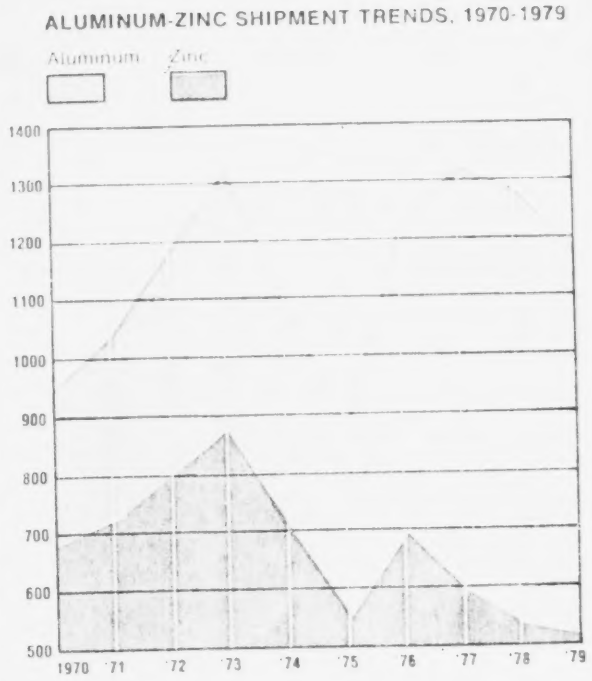
Type	% of reps. using	Respondents have	Projected industry total
Die temperature controls	19.5	200	1,200
Furnace controls	57.4	1,250	7,500
Shot controls	26.7	288	1,700
Metal temperature controls	61.0	1,333	8,000
Automatic process seq	34.9	790	4,700

PLANT SIZE BREAKDOWN
BY NUMBER OF EMPLOYEES



Average employees plant: 42.2



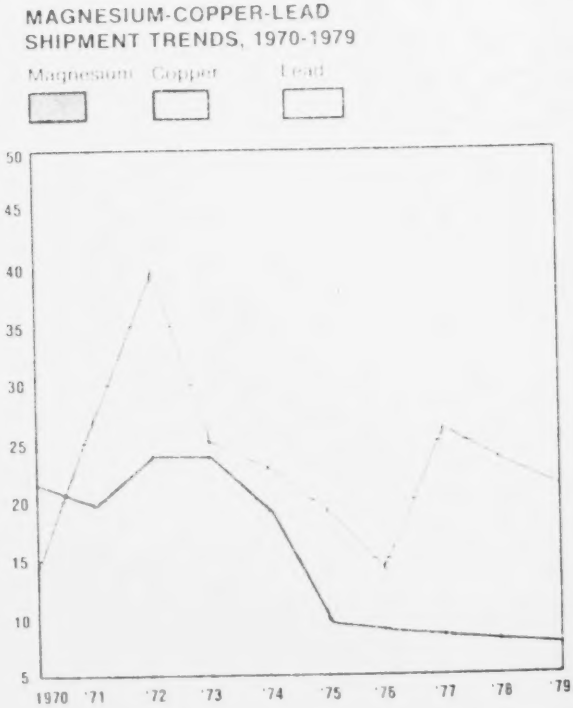


DIE CASTING SHIPMENTS 1970-1979

	1970	1971	1972	1973	1974
Aluminum					
Custom	385.9	399.3	465.3	522.7	457.2
Captive	556.8	622.4	726.7	781.9	633.4
Total	942.7	1021.7	1192.0	1304.6	1090.6
Zinc					
Custom	441.2	426.7	474.6	526.8	371.4
Captive	242.7	290.3	305.5	346.7	303.1
Total	683.9	697.0	780.1	873.5	674.5
Copper-base	21.5	20.0	23.0	23.0	17.9
Lead	45.3	44.1	46.0	40.7	38.6
Magnesium	14.0	27.2	38.0	24.2	23.9

	1975	1976	1977	1978	1979
Aluminum					
Custom	319.5	415.7	469.4	493.0	490.6
Captive	534.5	785.6	835.1	791.3	703.1
Total	854.0	1201.3	1304.6	1284.4	1193.9
Zinc					
Custom	307.4	401.5	355.0	343.8	343.9
Captive	237.3	277.5	242.3	199.8	160.6
Total	544.7	679.0	587.3	543.5	504.5
Copper-base	9.5	9.6	7.9	7.4	7.3
Lead	35.4	46.5	30.5	31.5	25.3
Magnesium	17.5	14.2	26.8	23.6	20.2

Amounts given in millions of lbs
Source: U.S. Dept. of Commerce
Note: Magnesium figures include permanent mold & other castings



Though certain parts of the die casting industry are affected more by depressed business conditions, the insutry as a whole seems to follow the economy. As the economy picks up, die casting producers can look for traditional markets to pick up as well. The applications of new die casting technology may also open up new markets for die cast products.

Trends in plans to buy die casting machines seem to follow the capacity distribution in the field. In hot chamber, most die casters surveyed have machines in the 100 to 400 ton range where plans to buy are the strongest. Some of the machines in the "under 100 ton" category could well reflect the expansion of mag-

EXPENDABLE SUPPLIES

Type	Respondents used	Average/ plant	Projected ind. total
Die steel	2,476,181 lb.	12,698.4 lb.	13,600,000 lb.
Die & Plunger lube	370,270 gal.	1,898.8 gal.	1,600,000 gal.
Hydraulic fluid	358,578 gal.	1,838.9 gal.	1,600,000 gal.
Crucibles	498	2.6	2600
Goose necks	643	3.3	2900
Melting kettles	831	4.3	3300
Plunger tips	9,447	48.4	43,000
Shot sleeves	1,369	7.0	5800
Plunger rings	64,908	332.9	320,000
Thermocouple tubes	7,012	36.0	31,000
Ladles & skimmers	7,836	40.2	33,000

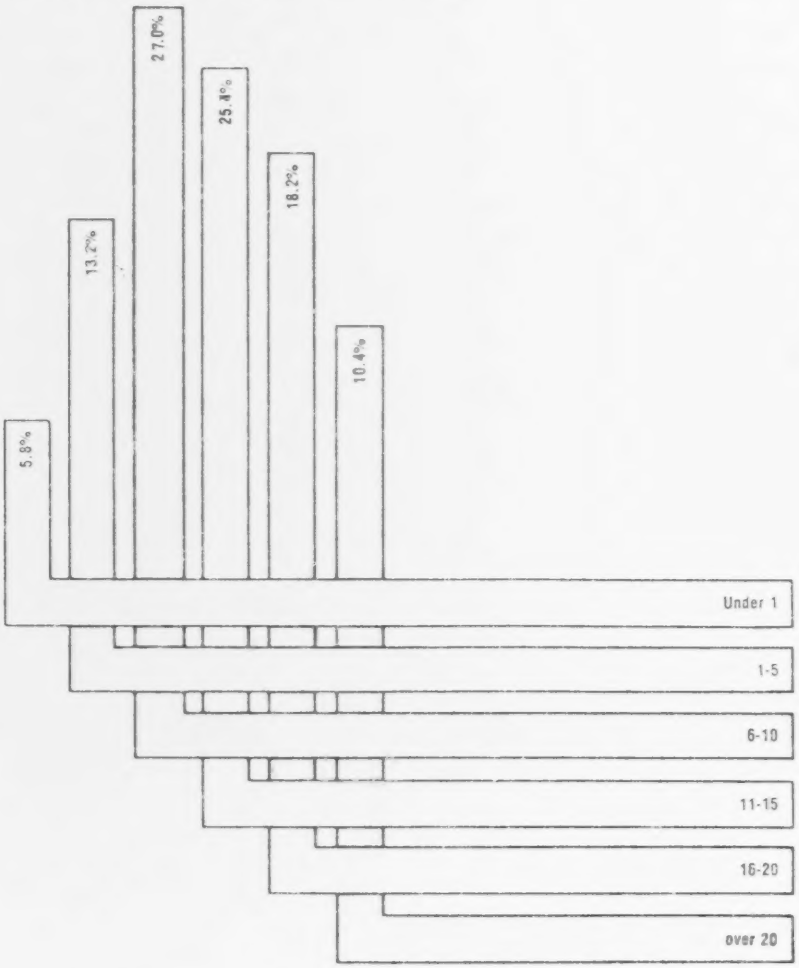
FINISHING EQUIPMENT

	Now Installed			Plan to buy by end 1981		
Type	Respondents have	Average/ plant	Projected ind. total	Number of plants	Number of machines	Projected ind. total
Vibratory	359	1.8	2,200	17	26	160
Polishing	203	1.0	1,200	2	2	10
Paint spray	69	0.4	410	2	2	10
Plating	45	0.2	270	2	2	10

TRIM PRESSES

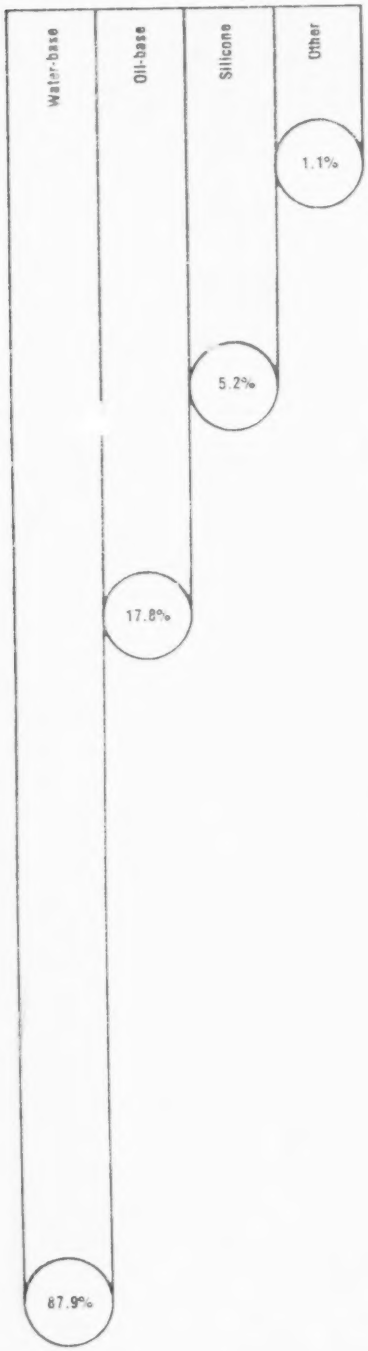
	Now Installed			Plan to buy by end 1981		
Type	Respondents have	Average/ plant	Projected ind. total	Number of plants	Number of machines	Projected ind. total
Mechanical	632	3.2	3,800	1	2	10
Hydraulic	1,254	6.4	7,500	79	81	490
Total	1,886	9.7	11,300	80	83	500

DIE CASTING MACHINE AGE DISTRIBUTION

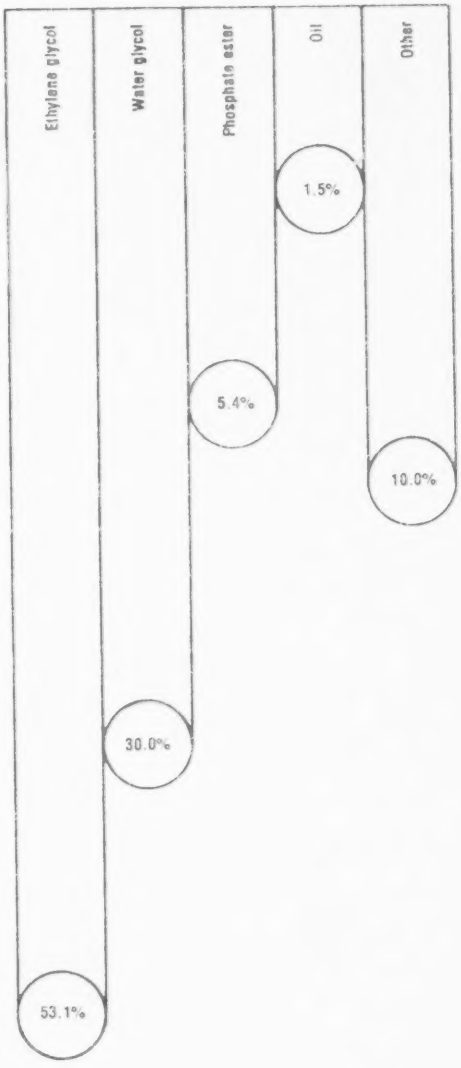


All age ranges are given in years

TYPES OF DIE & PLUNGER LUBRICANT USED



TYPES OF HYDRAULIC FLUID USED



nesium die casting capacity. The trend in cold chamber machine capacity is roughly the same, with the greatest distribution and plans to buy both in the 551—700 ton range.

Die casting machine age distribution puts most machines in the 12 year-old class. It can be assumed, therefore, that most machine purchases will be to increase capacity, although some machines are being replaced with more sophisticated units.

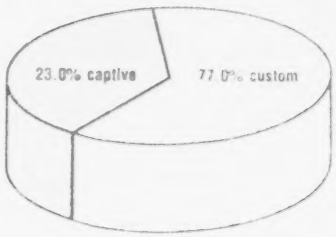
Fuel-fired melting and holding furnaces are used predominately in the die casting industry, and according to respondents' plans to buy, will remain so. However, our survey indicates that die casters are leaning toward electric heating for holding furnaces.

EXTRUSION

Questionnaires were sent to 205 management and production executives in the extrusion industry. A total of 106 usable responses were obtained, giving us a response rate of 51.7%. An industry total of 470 plants was assumed, giving us input from about one fourth of the industry. Industry totals for equipment were derived by multiplying respondents' totals by 4.5 and then rounding.

The extrusion industry has a fairly large captive segment of 23.0%. It is 77.0% custom. The average number of employees in extrusion plants we surveyed is 131.5. Plant size breakdown by pounds of metal shipped shows that 37.1% ship up to 5,000,000 lb annually, and 27.4% ship more than 20,000,000 lb of aluminum extrusions per year. Ten-year trends in aluminum extrusion shipments show a peak in 1978 and a very small decline, 0.94%, in 1979. Part of this decline was due to the sagging building and construction market. Exports were up in 1979, helping to offset small losses in other markets. Extruded tube and pipe, while somewhat less consistent, is also only down about 0.9%.

CUSTOM OR CAPTIVE?
According to our survey, the extrusion industry is . . .



GEOGRAPHIC DISTRIBUTION

Top numbers indicate percentage of extrusion plants in region. Bottom numbers indicate percentage of extrusion users in region. Based on computer analysis of PRECISION METAL circulation.

10-YEAR TRENDS IN ALUMINUM EXTRUSION SHIPMENTS

Extruded shapes	1979	1978	1977	1976	1975	1974	1973	1972	1971	1970
Building & construction	1,215	1,235	1,163	1,019	812	1,074	1,302	1,250	1,087	910
Transportation	499	491	427	350	234	424	437	328	227	236
Consumer durables	117	133	106	94	70	109	113	85	71	62
Electrical	105	101	89	94	76	117	114	97	91	87
Machinery & equipment	108	115	88	81	72	84	79	67	57	54
Containers & packaging	1	—	—	—	—	—	—	1	1	1
Other	28	24	31	43	33	48	49	48	52	52
Domestic, Total	2,074	2,099	1,904	1,681	1,299	1,856	2,094	1,876	1,586	1,402
Exports	22	17	9	10	14	18	17	8	8	11
Extruded shapes total	2,096	2,116	1,913	1,691	1,313	1,874	2,111	1,884	1,594	1,413
Extruded pipe & tube	**1979**	**1978**	**1977**	**1976**	**1975**	**1974**	**1973**	**1972**	**1971**	**1970**
Building & construction	31	29	31	33	27	42	46	47	46	45
Transportation	18	24	21	18	14	18	20	16	11	9
Consumer durables	21	28	22	18	13	19	21	20	17	16
Electrical	37	41	44	46	35	56	59	61	60	62
Machinery & equipment	29	35	45	53	31	65	55	39	40	33
Containers & packaging	—	—	—	—	—	—	—	—	—	—
Other	2	2	2	3	3	6	8	8	6	9
Domestic, Total	138	159	165	171	123	206	219	190	180	174
Exports	17	15	20	19	14	15	10	5	7	5
Extruded pipe & tube total	155	174	185	190	137	221	229	195	187	179

All figures are in millions of pounds.
Source: Aluminum Association

SHIPMENT TRENDS

Type	1980	1981		
		Increase	Decrease	About the same
Aluminum	4.4%	76.5%	5.9%	17.6%
Magnesium	0.0%	33.3%	—	66.7%
Steel	-31.8%	50.0%	50.0%	—
Ti-clad titanium	-22.0%	—	100.0%	—
Copper	-32.9%	—	—	100.0%

1980 figures indicate respondents' expected increase or decrease. The 1981 figures represent the percentage of respondents expecting 1981 shipments to be greater, smaller or about the same as 1980 shipments.

EXTRUSION PRESSES

Press size (tons)	Now installed			Plan to buy by end 1981		
	Respondents have	Average plant	Projected ind. total	Number of plants	Number of presses	Projected ind. total
Under 1000	33	0.5	150	0	0	0
1000-1499	35	0.5	160	0	0	0
1500-1999	47	0.7	210	4	4	30
2000-2999	37	0.6	170	4	4	20
3000-3999	16	0.2	70	0	0	0
4000-4999	9	0.1	40	0	0	0
5000-6999	14	0.2	60	1	2	10
7000 & over	5	0.1	20	0	0	0
Total	196	2.9	880	9	10	45

AUXILIARY EQUIPMENT

Type	Now installed			Plan to buy by end 1981		
	Respondents have	Average plant	Projected ind. total	Number of plants	Number of machines	Projected ind. total
Billet saws	72	1.1	320	5	5	25
Billet shears	15	0.2	70	5	6	28
Runout tables	163	2.5	730	10	15	70
Stretchers, detwisters	176	2.7	780	10	15	70
Billet casters	44	0.7	200	2	2	10
Billet heaters, fuel	109	1.7	490	2	4	20
Billet heaters, induction	70	1.1	320	6	7	30
Heat treat ovens	134	2.0	600	4	6	25
Cut-off saws	283	4.3	1300	10	18	60
Burner controls	186	2.8	840	2	3	15

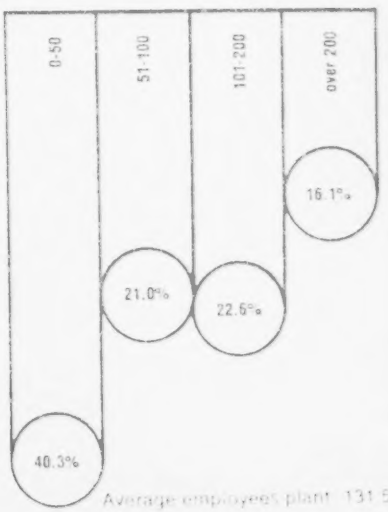
EXPENDABLE SUPPLIES

Type	Plants responding	Respondents used	Average plant	Projected ind. total
Fire-resistant hydraulic fluid	14	38,730 gal	2,766 gal	220,000 gal
Petroleum hydraulic fluid	39	216,625 gal	5,385 gal	1,200,000 gal
Die lubricants	37	11,346	307	65,000 gal
Graphite	33	16,420 ft²	497 ft²	90,000 ft²
Dummy blocks	45	1,369	30.5	7,700
Holder blocks	10	495	49.5	2,400
Containers	34	270	7.9	1,900
Rams	40	148	3.7	880
Liners	35	99	2.8	680
Mandrels	12	1,009	84.0	20,000

Our survey indicates that there are currently 881 extrusion presses installed in the industry. Most are in the 1500 to 1999 and 2000 to 2999 ton categories. Our projection shows that extruders are planning to buy 50 extrusion presses with 40 of these in those two size ranges.

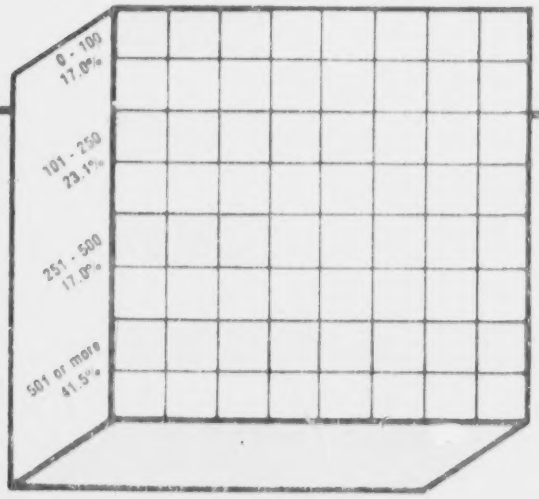
Of the 31,201 new dies used by extruders in the past year, 58.1% were for new shapes, indicating a trend toward designing with extruded aluminum. Extruders surveyed also offer the most often specified secondary operations, including machining, anodizing, fabricating and punching and notching.

PLANT SIZE BREAKDOWN BY NUMBER OF EMPLOYEES



Average employees/plant: 131.5

PLANT SIZE BREAKDOWN BY TOOLING REQUIREMENTS

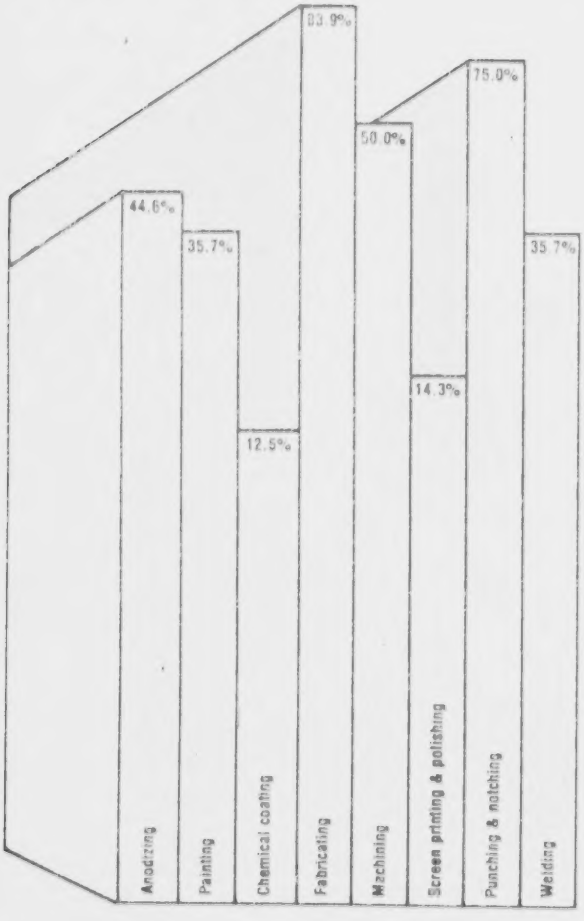


Ranges indicate new dies per year per plant.
Total new dies: 31,201
58.1% of these were for new shapes
18.0% were made inhouse
82.0% were made by outside diemaker

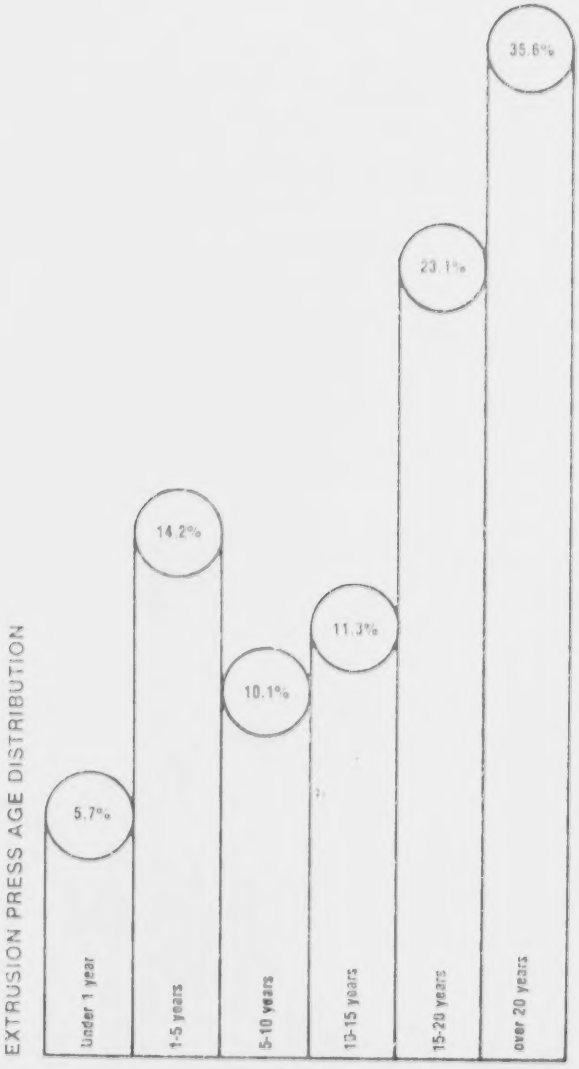
PLANT SIZE BREAKDOWN BY SHIPMENTS

0-4,999,999 lb	37.1%
5,000,000-9,999,999 lb	27.4%
10,000,000-19,999,999 lb	14.5%
20,000,000 lb or more	21.0%

SECONDARY OPERATIONS



EXTRUSION PRESS AGE DISTRIBUTION



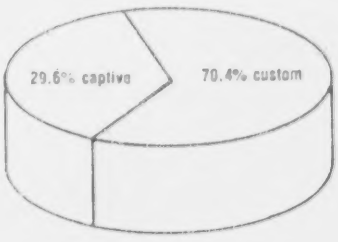
FORGING

Detailed questionnaires were sent to 566 management or production executives in the forging industry. A total of 158 useful responses were received, for a response rate of 27.9%.

An industry total of 950 plants was assumed. Our 158 useful responses thus represented about one-sixth of the forging industry. Industry totals for capital equipment were estimated by multiplying the totals for our respondents by six and then rounding. Expendable supplies totals were estimated by taking the percentage of industry shipments reported by our respondents, multiplying by the totals for expendable supplies reported by our respondents and then multiplying by a "usage factor" for each type of expendable supply.

Our survey indicates that buying plans are slightly depressed at present due to economic conditions. However, the dropoff is not as severe as might be expected in a recession such as this. Part of this may be explained by the age distribution charts, particularly for forming equipment. Many of the industry's hammers and presses are over 20 years old; some of

CUSTOM OR CAPTIVE?
In 1979, our respondents indicated that the forging industry was . . .



WHERE IS THE FORGING INDUSTRY LOCATED?

Based on computer analysis of PRECISION METAL circulation.
Top number indicates percentage of forging plants in each region.
Bottom number indicated percentage of forging users in each region.

this equipment will likely be replaced with newer, more productive equipment in the next few years. Aerospace forgings often have long lead times. Although EIA claims the present backlog is due to material supply problems rather than lack of installed capacity, future demand may outstrip available capacity.

Perhaps the biggest buying plans are in heating equipment. There is a strong trend from oil-fired heating equipment to gas-fired and electric equipment. Only 3.8% of the heating equipment our respondents plan to buy is oil-fired. Some furnaces are being ordered with dual-fuel capability; they can burn either gas or oil. Oil-fired furnaces are also being converted to burn gas in increasing numbers.

The switch from oil to gas and electric is undoubtedly linked to the rapidly escalating price of oil and questions about its future availability. This situation is in stark contrast to that of just a few years ago, when gas supplies to many plants were curtailed during the wintertime and new gas installations were prohibited in some areas. Induction heating is also continuing to make inroads into the forging market.

The portion of our survey on tooling requirements showed that 77.2% of the responding plants make their own dies. Of those firms not making their own dies, 11.8% described their tool-room repair capabilities as extensive, 58.8% as moderate, 23.5% as very little, and 5.9% as having none. Trim dies are made in-plant by 70.7% of our responding plants.

SHIPMENT TRENDS

Metal	1980	1981		
		Increase	Decrease	About the same
Aluminum	– 7.3%	61.9%	4.8	33.3
Alloys steel	– 7.4%	57.0	15.1	27.9
Brass/copper	+ 0.4%	33.3	5.6	61.1
Stainless steel	+18.2%	62.9	2.8	34.3
Other	– 8.7%	61.2	18.4	20.4

1980 figures indicate expected increase or decrease in shipment volume as reported by respondents to our questionnaire. The figures for 1981 represent the percentage of respondents expecting 1981 shipments to be greater, smaller or about the same as 1980 shipments.

STEAM & AIR HAMMERS

Size (lb)	Now installed			Plan to buy by end 1981		
	Respondents have	Average/ plant	Projected ind. total	Number of plants	Number of machines	Projected ind. total
less than 1000	26	0.2	160	1	2	10
1001-5000	377	3.4	2300	12	19	110
5001-10,000	63	0.4	380	0	0	0
10001-25,000	19	0.1	110	2	2	10
25,001+	2	0.0	10	1	2	10
Total	487	3.1	2900	14	25	150

BOARD HAMMERS

Size (lb)	Now installed			Plan to buy by end 1981		
	Respondents have	Average/ plant	Projected ind. total	Number of plants	Number of machines	Projected ind. total
less than 1000	44	0.3	260	1	1	5
1001-5000	281	1.8	1700	6	12	70
5001-10,000	2	0.0	10	0	0	0
10,001-25,000	0	0.0	0	0	0	0
25,001+	0	0.0	0	0	0	0
Total	327	2.1	2000	7	13	80

MECHANICAL PRESSES

Size (tons)	Now installed			Plan to buy by end 1981		
	Respondents have	Average/ plant	Projected ind. total	Number of plants	Number of machines	Projected ind. total
100-500	113	0.7	680	3	3	20
501-1000	63	0.4	380	1	1	5
1001-2000	68	0.4	410	4	4	25
2001-5000	35	0.2	210	2	3	20
5001-10,000	6	0.0	40	2	2	10
10,000+	1	0.0	10	1	1	5
Total	286	1.8	1700	11	14	85

HYDRAULIC PRESSES

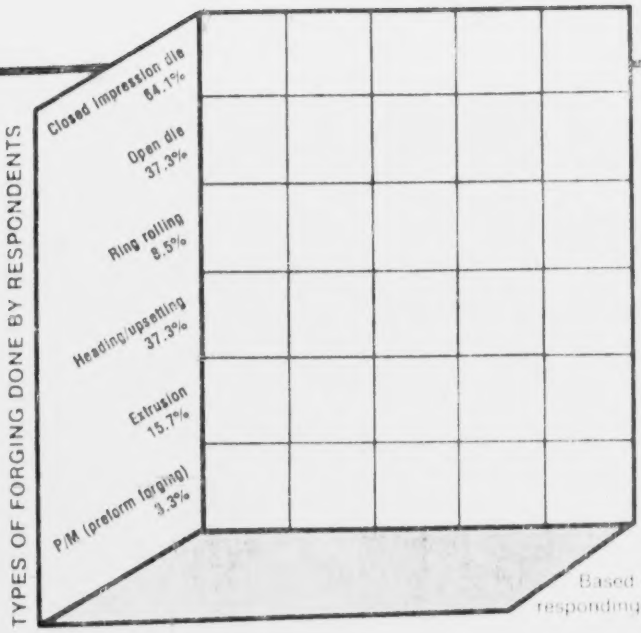
Size (tons)	Now installed			Plan to buy by end 1981		
	Respondents have	Average/ plant	Projected ind. total	Number of plants	Number of machines	Projected ind. total
100-500	38	0.2	230	0	0	0
501-1,000	28	0.2	170	4	4	25
1,001-2,000	35	0.2	210	2	2	10
2,001-5,000	19	0.1	110	5	6	35
5,001-10,000	5	0.0	30	1	1	5
10,000+	1	0.0	10	0	0	0
Total	126	0.8	760	11	13	80

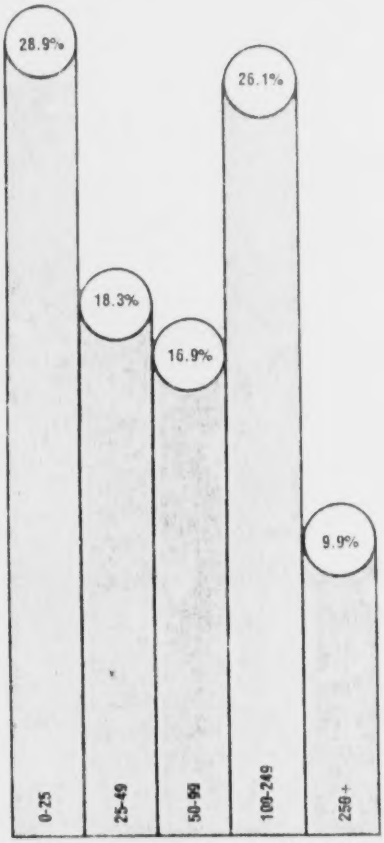
TRIM PRESSES

Size (tons)	Now installed			Plan to buy by end 1981		
	Respondents have	Average/ plant	Projected ind. total	Number of plants	Number of machines	Projected ind. total
50-200	791	5.0	4,700	4	13	80
201-300	122	0.8	730	1	1	5
301-400	79	0.5	470	1	1	5
400+	26	0.2	160	3	5	30
Total	1,018	6.4	6,100	9	20	120

UPSETTERS

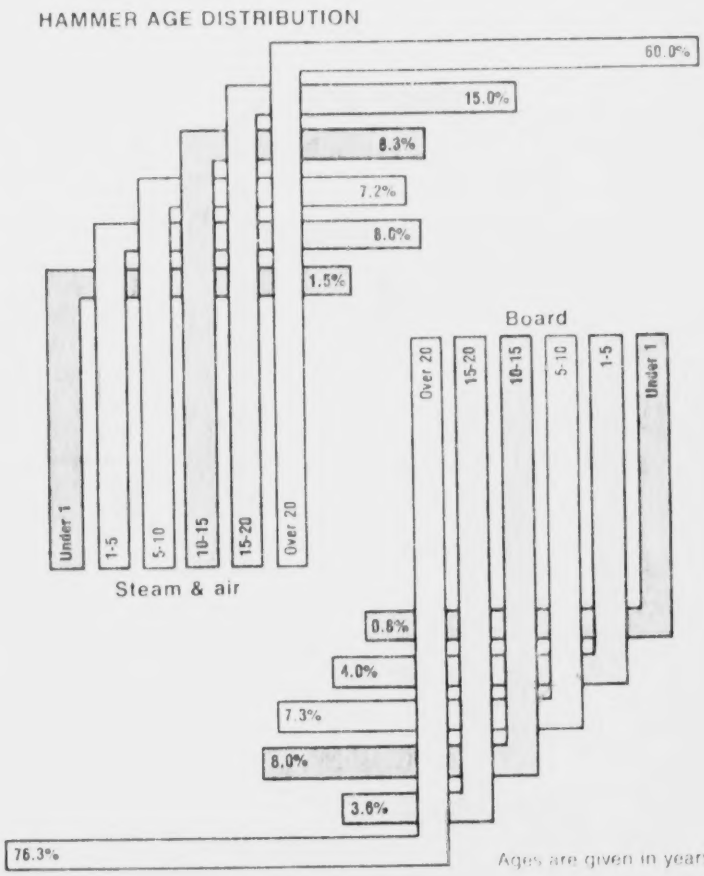
Size (in.)	Now installed			Plan to buy by end 1981		
	Respondents have	Average/ plant	Projected ind. total	Number of plants	Number of machines	Projected ind. total
1/2	4	0.0	20	0	0	0
1	21	0.1	130	0	0	0
1-1/2	32	0.2	190	1	1	5
2	46	0.3	280	1	1	5
2-1/2	19	0.1	110	1	1	5
3-4	74	0.5	440	1	1	5
5-6	24	0.2	140	4	5	30
Total	220	1.4	1,300	4	9	55





DISTRIBUTION OF PLANTS BY NUMBER OF EMPLOYEES

Average per plant: 105.4



COLD HEATERS

Size (in.)	Now installed: Respondents have	Now installed: Average/ plant	Now installed: Projected ind. total	Plan to buy by end 1981: Number of plants	Plan to buy by end 1981: Number of machines	Plan to buy by end 1981: Projected ind. total
1/8 - 1/4	77	0.5	460	0	0	0
1/4-1/2	93	0.6	560	1	1	5
1/2-3/4	65	0.4	390	3	3	20
3/4-1	19	0.1	110	1	1	5
over 1	11	0.1	70	1	2	10
Total	265	1.7	1,600	5	7	40

OIL-FIRED BAR & BILLET HEATERS

Type	Now installed: Respondents have	Now installed: Average/ plant	Now installed: Projected ind. total	Plan to buy by end 1981: Number of plants	Plan to buy by end 1981: Number of machines	Plan to buy by end 1981: Projected ind. total
Box	107	0.7	640	1	1	5
Rotary hearth	10	0.1	60	0	0	0
Roller hearth	2	0.0	10	0	0	0
Continuous belt	11	0.1	70	0	0	0
Slot	348	2.2	2,100	4	4	25
Pusher	15	0.1	90	0	0	0
Total	493	3.1	3,000	4	5	30

GAS-FIRED BAR & BILLET HEATERS

Type	Now installed: Respondents have	Now installed: Average/ plant	Now installed: Projected ind. total	Plan to buy by end 1981: Number of plants	Plan to buy by end 1981: Number of machines	Plan to buy by end 1981: Projected ind. total
Box	308	1.9	1,800	16	56	340
Rotary hearth	39	0.2	230	6	9	55
Roller hearth	3	0.0	20	0	0	0
Continuous belt	81	0.5	490	1	1	5
Slot	278	1.8	1,700	7	18	110
Pusher	20	0.1	120	1	2	10
Total	729	4.6	4,400	27	86	520

ELECTRIC BAR & BILLET HEATERS

Type	Now installed: Respondents have	Now installed: Average/ plant	Now installed: Projected ind. total	Plan to buy by end 1981: Number of plants	Plan to buy by end 1981: Number of machines	Plan to buy by end 1981: Projected ind. total
Induction	260	1.6	1,600	31	37	220
Resistance	81	0.5	490	2	3	20
Total	341	2.2	2,000	32	40	240

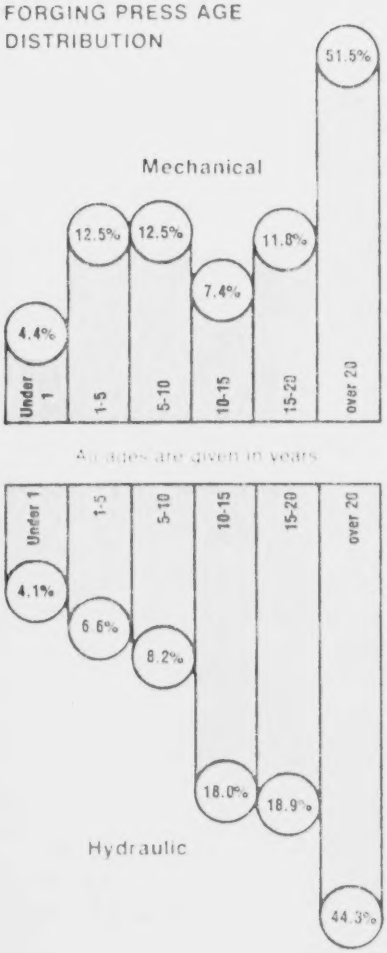
HEAT TREATING FURNACES

Type	Now installed: Respondents have	Now installed: Average/ plant	Now installed: Projected ind. total	Plan to buy by end 1981: Number of plants	Plan to buy by end 1981: Number of machines	Plan to buy by end 1981: Projected ind. total
Induction	73	0.5	440	4	4	25
Fuel-fired	426	2.7	2,600	19	26	160
Total	499	3.2	3,000	22	30	180

AUXILIARY EQUIPMENT

Type	Now installed: Respondents have	Now installed: Average/ plant	Now installed: Projected ind. total	Plan to buy by end 1981: Number of plants	Plan to buy by end 1981: Number of machines	Plan to buy by end 1981: Projected ind. total
Automatic lubricators	317	2.0	1,900	9	22	130
Billet saws	357	2.3	2,100	11	18	110
Billet shears	184	1.2	1,100	6	6	35
Blast cleaning eqpt	203	1.3	1,200	10	12	70
Conveyors	404	2.6	2,400	8	25	150
Die making mach:						
EDM	117	0.7	700	7	7	40
Duplicating	137	0.9	820	8	9	55
Hobbing	14	0.1	80	1	1	5
N/C	36	0.2	220	5	11	65
Manipulators	70	0.4	420	10	20	120
P/M preform presses	3	0.0	20	0	0	0
Ring rollers	21	0.1	130	2	2	10
Robots	19	0.1	110	2	3	20
Sintering furnaces	1	0.0	10	0	0	0
Process controls:						
For furnaces	123	0.8	740	7	12	70
For forming eqpt	22	0.1	130	1	1	5

FORGING PRESS AGE DISTRIBUTION



FORGING INDUSTRY ASSOCIATION DATA

SALES OF COMMERCIAL CLOSED DIE FORGINGS 1971-1979

TYPE OF METAL	1971		1974		1976		1978		1979	
	Dollars	Net Wt. (tons)	Dollars	Net Wt. (tons)	Dollars	Net Wt (tons)	Dollars	Net Wt. (tons)	Dollars	Net Wt. (tons)
FERROUS										
Carbon Steel	388,488	803 6	617,346	879 1	656,800	750 6	824 730	734 1	976,730	712 9
Common Alloy Steel	214,492	322 3	407 804	393 7	494,100	399 1	624 744	405 5	745,618	425 7
Stainless Steel	45,839	12 2	71,246	15 2	64,100	12 8	80 755	11 5	93,965	11.0
TOTAL FERROUS	648,819	1138 1	1,096,396	1288 0	1,215,000	1 162 5	1,530,031	1,150 0	1,816,313	1149 7
NON-FERROUS										
Aluminum	82,544	31 0	129,562	37 1	141,600	32 8	223,504	40 3	292 232	48 3
Titanium	62,854	4 4	89,327	4 3	126,200	4 6	143,971	5 1	172,059	5 1
Brass & Copper	53,142	26 5	153,666	28 3	99,400	21 6	103,798	26 0	122,482	27 7
Other Nonferrous*	5,042	2 0	5,260	1 0	7,200	0 8	8,841	0 5	11,025	0 5
TOTAL NONFERROUS	203,569	63 0	377,905	71 4	374,400	5 9	480,114	73 9	597,798	81.6
TOTAL HI-TEMP**	81,355	8.1	108,323	8 5	124,900	6 1	157,558	7 2	194,589	7 9
TOTAL $ VOLUME	933,722		1,582,624		1,714,300		2,167,703		2,608,700	

* Other includes magnesium, zinc and other.

** Those alloys whether iron, nickel or cobalt base or others suitable for use at temperatures of 1000F.

All dollar and weight values are expressed in thousands.

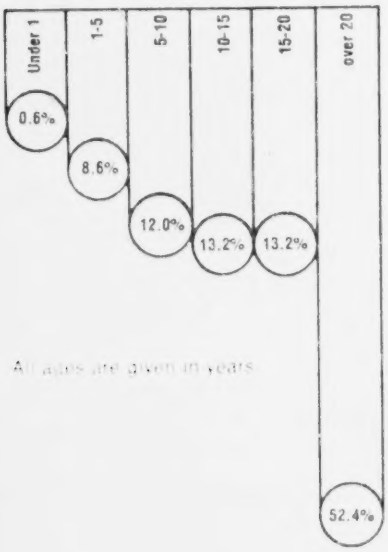
This data does not include (1) shipments of aircraft blades and buckets from specialized shops devoted primarily to that work; (2) products forged at temperatures below 300 F; (3) forged "catalog" items; and (4) forgings shipped to affiliated plants or concerns.

MAJOR END-USE MARKETS	1971		1974		1976		1978		1979	
	Ind. Sales $ Volume	% Of Sales	Ind. Sales $ Volume	% Of Sales	Ind. Sales $ Volume	% Of Sales	Ind. Sales $ Volume	% Of Sales	Ind. Sales $ Volume	% Of Sales
1. Farm Machinery	36,780	4 0	80,714	5 1	93,601	5 5	106,218	4 9	127,825	4 9
2. Aircraft										
Engines & Engine Parts	112,980	12 1	163 010	10 3	206,745	12 1	236,280	10 9	323,479	12 4
Aircraft, Parts & Auxiliary Eqpt	92,065	9 9	151,932	9 6	184,973	10 8	234,112	10 8	318,261	12 2
Guided Missiles, Space Vehicles & Parts	21,662	2 3	22,157	1 4	22,457	1 3	30,348	1 4	33,913	1 3
3. Automotive:	74,885	8 0	98,123	6 2	125,315	7 3	160,410	7 4	190,435	7 3
Passenger Cars & Parts	127,360	13.6	261,133	16 5	295,545	17 2	398,857	18 4	409,566	15 7
Trucks, Buses, Trailers & Related Parts										
4. Internal Combustion Engine	14,379	1 4	22,157	1 4	25,029	1 5	28,180	1 3	33,900	1 3
5. Metalworking & Special Ind (not mtlwrkg) Machinery	13,259	1 6	47,479	3 0	40,457	2 3	52,025	2 4	46,957	1 8
6. Mech. Power Transmission Eqpt (incl. Bearings)	13,166	1 4	25,332	1 6	20,229	1 2	43,354	2 0	60,000	2 3
7. Nuclear	15,133	1 6	26,905	1 7	—	—	—	—	—	—
8. Fabricated Plate Work & Special Ind. Eqpt. not classified	—	—	—	—	17,657	1 0	21,677	1 0	23,478	0 9
9. Off-Highway Eqpt.	133,655	14 1	223,150	14 1	239,831	14 0	299,143	13 8	349,566	13.4
10. Ordnance (except missiles)	56,677	6 1	61,722	3 9	77,658	4 5	58,528	2 7	65,218	2.5
11. Oil Field Machinery & Eqpt.	16,714	1 8	39,566	2 5	42,686	2 5	62,836	2 9	70,435	2 7
12. Plumbing Fixtures, Valves & Fittings	32,587	3 5	94,957	6 0	78,001	4 6	95,379	4 4	96,522	3 7
13. Pumps & Compressors	15,126	1 6	11,078	0 7	8,742	0 5	13,006	0 6	20,870	0 8
14. Railroad Eqmt.	26,238	2 8	68,053	4 3	52,972	3 1	97,547	4 5	125,218	4 8
15. Refrigeration, Air Conditioning and Heat Eqpt.	9,337	1 0	23,739	1 5	21,600	1 2	15,147	0 7	41,739	1 6
16. Steam Engines & Turbines	15,406	1 7	31,652	2 0	28,972	1 7	41,186	1 9	36,522	1 4
17. Other	108,125	11 6	129,775	8 2	131,830	7 7	173,416	8 0	219,143	8 4
TOTALS	**933,734**	**100.0**	**1,582,624**	**100.0**	**1,714,300**	**100.0**	**2,167,703**	**100.0**	**2,608,700**	**100.0**

EXPENDABLE SUPPLIES

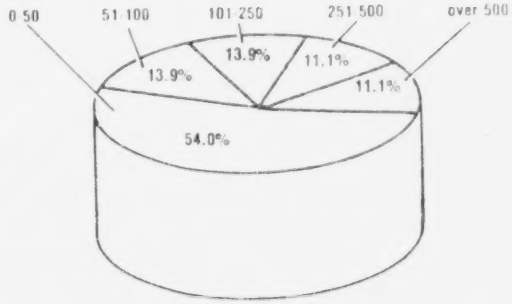
Type	Plants	Quantity used	Projected ind. total
Hot work die steel	80	11,098,630 lb	77,000,000 lb
Die lube	70	328,249 gal	2,900,000 gal
Fire resistant hyd. fluid	46	65,919 gal	600,000 gal
Firebrick	67	722,221 bricks	3,700,000 bricks
Ceramic fiber insulation	41	53,515 ft.²	310,00 ft.²
Blast cleaning supplies:			
Sand	25	113,700 lb	580,000 lb.
Shot	55	2,700,600 lb	17,000,000 lb
Glass beads	22	119,200 lb	770,000 lb
Abrasive wheels	48	62,350	560,000

TRIM PRESS AGE DISTRIBUTION



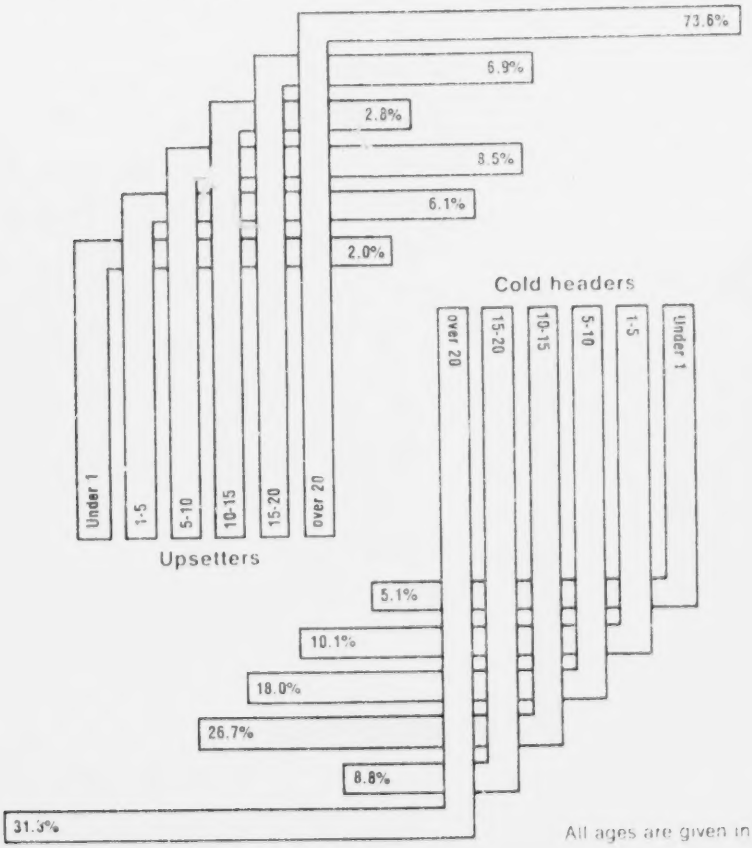
All ages are given in years

TOOLING REQUIREMENTS



Numbers in wedges on pie chart indicate number of dies per plant
Based on 108 respondents
Total: 35,982 new dies
Average per plant: 330
Projected industry total: 210,000 new dies in 1979

UPSETTER & HEADER AGE DISTRIBUTION



All ages are given in years

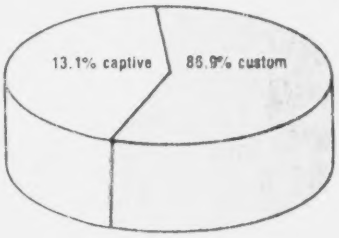
INVESTMENT CASTING

Questionnaires were sent to 239 management and production executives in the investment casting industry. A total of 121 usable responses were obtained, giving us a response rate of 51%. An industry total of 300 plants was assumed. Our sample therefore comprise more than one third of existing investment casting plants. Industry totals for equipment was obtained by multiplying total responses by 2.5.

Our survey showed that of the investment casting plants responding, 86.9% are custom and 13.1% are captive. The average investment casting plant in our survey employs 135.9 people.

Projected industry totals for shipments indicate the largest shipments were in stainless steel, followed by superalloys and high temperature alloys. The trend for 1981 shows investment casters expect increases in shipments of superalloy and high temperature alloys castings as well as high and low carbon steel. Our survey indicates that high temperature alloy shipments will be up 74.7% and titanium shipments will be up 47.7%.

CUSTOM OR CAPTIVE?
Our respondents reported that, in 1979, the investment casting industry was . . .



GEOGRAPHIC DISTRIBUTION

Top numbers indicate percentage of investment casting plants in region. Bottom numbers indicate percentage of investment casting users in region. Based on computer analysis of PRECISION METAL circulation.

in 1980. One hundred percent of respondents surveyed think titanium casting shipments will be up again in 1981. Aluminum, stainless steel and high-temperature alloys promise to be growth markets for investment castings in 1981 as well.

Capital equipment purchases indicate a cautious optimism, with no concentrated buying indicated in any specific area. The largest additions seem to be in the area of furnace controls, where investment casters may be trying to offset the high cost of energy with more efficient furnaces.

Despite investment casting's use for blades, vanes and other high-integrity aerospace components, its biggest market according to our survey — is for industrial applications. General structural aerospace and blade and vane business combined comprise 24.8% of shipments, while industrial accounts for 41.3%.

SHIPMENTS (1979)

Metal	Respondents' 1979 shipments (lb)	Projected industry totals (lb)
Aluminum	1,121,350	5,300,000
Copper	431,120	2,100,000
Magnesium	73,000	350,000
Titanium	330,000	1,600,000
Low-carbon steel	1,218,200	5,800,000
High-carbon steel	913,700	4,400,000
Low-alloy steel	3,206,000	15,000,000
High-alloy steel	2,667,700	13,000,000
Stainless steel	10,909,700	52,000,000
Superalloys	7,386,000	35,000,000
High-temperature alloys	4,251,000	20,000,000
Total	32,507,700	150,000,000

SHIPMENT TRENDS

Metal	1980 change	1981 trend		
		increase	decrease	about the same
Aluminum	+19.4%	71.1	5.3	23.6
Copper	– 3.5%	58.1	9.7	32.2
Magnesium	+ 4.1%	—	—	—
Titanium	+47.7%	100.0	—	—
Low-carbon steel	+34.9%	74.4	10.3	15.3
High-carbon steel	+22.0%	76.3	5.3	18.4
Low-alloy steel	+ 3.5%	78.6	7.1	14.3
High-alloy steel	+12.7%	77.3	6.8	15.9
Stainless steel	+ 5.7%	89.7	5.2	5.2
Superalloys	+25.9%	72.4	6.9	20.7
High-temperature alloys	+74.7%	80.0	5.0	15.0

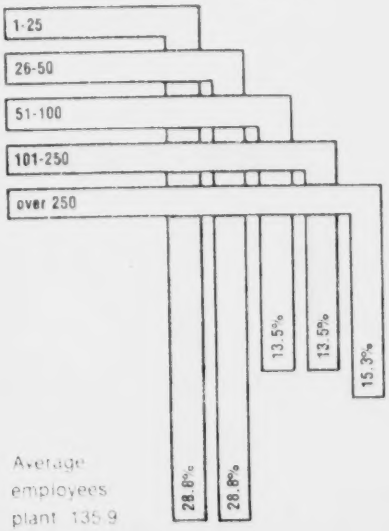
CAPITAL EQUIPMENT

	Now installed			Plan to buy by end 1981		
	Respondents have	Average/ plant	Projected ind. total	Number of plants	Number of units	Projected ind. total
Autoclaves	114	1.0	290	19	19	50
Blast cleaning equipment	403	3.5	1,000	29	42	110
Burnout furnaces	404	3.5	1,000	26	55	140
Dipping eqpt.	76	0.7	200	20	29	75
Fluidized beds	404	3.5	1,000	29	75	190
Furnace controls	355	3.1	920	12	28	70
Heat treating furnaces	157	1.4	410	24	32	85
Melting furnaces	365	3.1	940	21	29	75
Microwave dewaxers	9	0.1	20	3	4	10
Molten metal furnaces	85	0.7	220	5	12	30
Plastic molding machines	72	0.6	190	6	8	20
Robots	40	0.3	100	12	21	55
Stucco units	192	1.7	500	10	36	95
Vacuum casting eqpt.	112	1.0	290	14	28	70
Wax extruders	91	0.8	240	15	32	85
Wax injectors	776	6.7	2,000	42	144	370

EXPENDABLE SUPPLIES

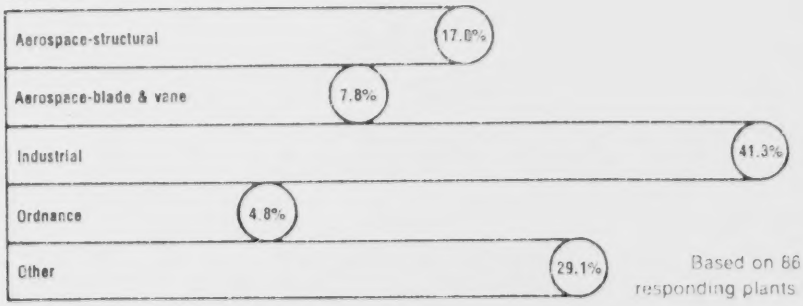
Types	Plants Responding	Respondents used	Average/ plant	Projected ind. total
Sand	38	1,616,280 lb.	42,533 lb.	6,400,000 lb.
Shot	22	349,050 lb.	15,866 lb.	1,400,000 lb.
Grit	23	469,300 lb.	20,404 lb.	1,800,000 lb.
Glass beads	22	77,740 lb.	3,533 lb.	310,000 lb.
Crucibles	67	38,510	575	160,000
Cut-off wheels	60	118,369	1,973	490,000
Grinding wheels	36	112,679	3,130	470,000
Investment binders	53	2,657,259 gal.	50,136 gal.	15,000,000 gal.
Investment materials	63	20,327,775 lb.	322,663 lb.	97,000,000 lb.
Pattern wax	72	7,714,742 lb.	107,149 lb.	32,000,000 lb.
Precoat materials	19	2,131,502 lb.	112,184 lb.	8,900,000 lb.
Preformed cores	10	1,329,100	132,910	5,500,000

PLANT SIZE BREAKDOWN BY NUMBER OF EMPLOYEES



Average employees/plant: 135.9

END-USE MARKETS



Based on 86 responding plants

POWDER METALLURGY

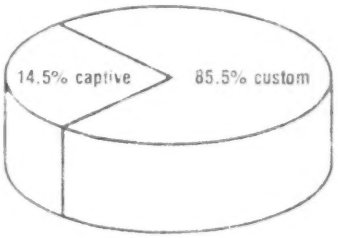
Questionnaires were sent to 325 management and production executives in the P/M industry. A total of 120 usable responses were obtained, giving us a response rate of 37%. An industry total of 400 plants was assumed, over which projected totals were made. Our usable response, therefore, represented about 30% of the P/M industry.

According to our survey, the P/M industry is 85.5% custom and 14.5% captive. P/M parts producers have, on the average, 75.6 employees.

The greatest market for P/M parts is in iron and steel, with our survey showing the shipment of 470,000,000 lb of iron steel parts in 1980. As might be expected, P/M producers expect iron and steel to be a major growth area in 1981, with 73.8% of responding companies anticipating an increase in iron and steel shipments in 1981. Much of this will likely be tied to increases in automobile production. As a matter of fact, for nearly all major strucutral P/M materials, the companies surveyed expect a substantial increase for the coming yr.

Mechanical compacting presses predominate the P/M industry, with a projected total of 4200 units, compared to 960 for hydraulic compacting presses. P/M parts fabricators in-

CUSTOM OR CAPTIVE?
According to our survey, the P/M parts industry is . . .



GEOGRAPHIC DISTRIBUTION

Top numbers indicate percentage of P/M plants in region. Bottom numbers indicate percentage of P/M users in region. Based on computer analysis of PRECISION METAL circulation.

SHIPMENTS

Metal or alloy	Respondents shipped (lb)	Projected industry total (lb)
Aluminum	2,050	12,000
Brass	1,576,600	9,000,000
Bronze	4,483,500	26,000,000
Iron or steel	81,986,123	470,000,000
Stainless steel	1,171,410	6,700,000
Copper	1,217,520	5,900,000
Tungsten	893,200	5,100,000
Tungsten carbide	436,600	2,500,000
Cobalt	54,100	310,000
Tantalum	40,000	230,000
Other	10,408,060	59,000,000
Total	102,269,163	580,000,000

SHIPMENT TRENDS

	1980	1981		
Metal or alloy		Increase	Decrease	About the same
Aluminum	+28.8%	15.4%	0.0%	84.5%
Brass	- 5.1%	45.5%	4.6%	50.0%
Bronze	- 8.0%	44.0%	8.0%	48.0%
Iron or steel	- 1.8%	73.8%	7.1%	19.1%
Stainless steel	-23.1%	56.5%	4.4%	39.1%
Copper	- 4.9%	—	—	—
Tungsten	+ 5.5%	—	—	—
Tungsten carbide	+12.6%	—	—	—
Cobalt	+24.7%	—	—	—
Tantalum	+25.0%	—	—	—

1980 figures indicate respondents' expected increase or decrease. The 1981 figures represent the percentage of respondents expecting 1981 shipments to be greater, smaller or about the same as 1980 shipments.

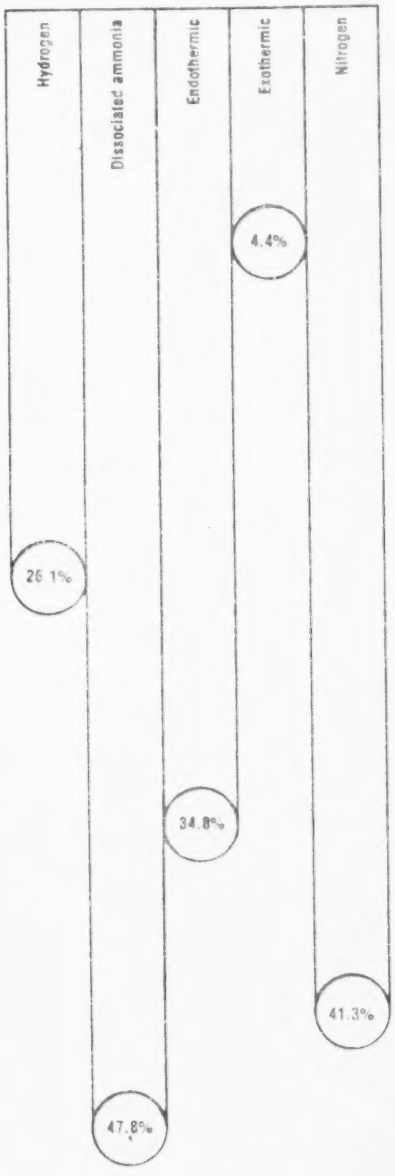
LUBRICANTS

Type	Plants responding	Respondents used (lb)	Projected ind. total (lb)
Graphite	33	375,520	3,000,000
Lithium stearate	23	90,640	710,000
Zinc stearate	32	240,585	1,900,000
Stearic acid	19	45,830	360,000
Wax	34	120,250	950,000
Total	47	872,825	6,900,000

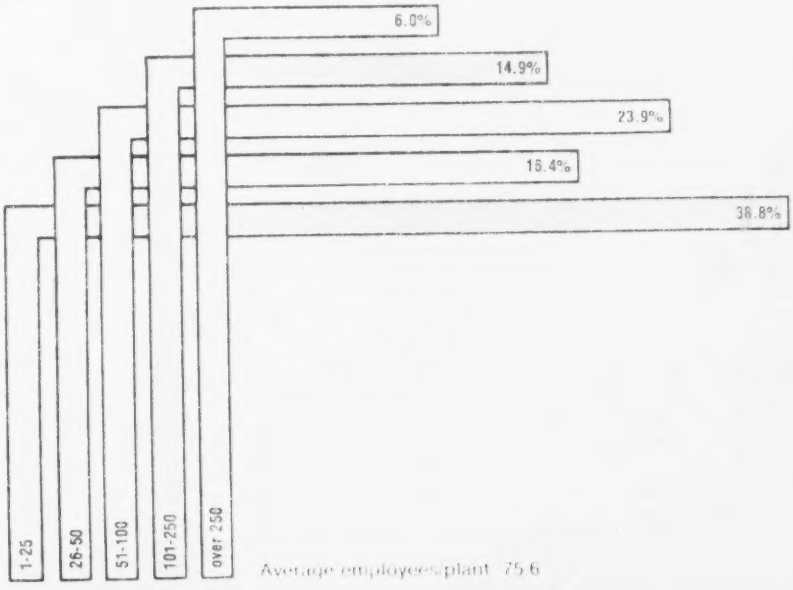
PLANT SIZE BREAKDOWN BY SHIPMENTS

Shipments	Percentage
0- 100,000 lb	35.1
100,000- 500,000 lb	14.0
500,000- 1,000,000 lb	8.8
1,000,000- 2,000,000 lb	15.8
2,000,000- 5,000,000 lb	14.0
5,000,000-10,000,000 lb	5.3
10,000,000 + lb	3.5

SINTERING ATMOSPHERE DISTRIBUTION



PLANT SIZE BREAKDOWN BY NUMBER OF EMPLOYEES



Average employees/plant: 75.6

MECHANICAL COMPACTING PRESSES

Size (tons)	Now installed			Plan to buy by end 1981		
	Respondents have	Average/ plant	Projected ind. total	Number of plants	Number of presses	Projected ind. total
Under 20	180	2.7	1,100	11	21	130
20-40	176	2.7	1,100	5	7	40
41-80	138	2.1	640	7	15	90
81-100	94	1.4	570	5	7	40
101-200	70	1.1	420	8	9	55
over 200	31	0.5	190	6	7	40
Total	689	10.4	4,200	27	66	400

HYDRAULIC COMPACTING PRESSES

Size (tons)	Now installed			Plan to buy by end 1981		
	Respondents have	Average/ plant	Projected ind. total	Number of plants	Number of presses	Projected ind. total
Under 20	15	0.2	90	2	6	35
20-40	31	0.5	190	4	6	35
41-80	14	0.2	80	3	3	20
81-100	18	0.3	110	1	1	5
101-200	32	0.5	190	3	3	20
over 200	49	0.7	300	7	8	50
total	159	2.4	960	16	27	160

COINING PRESSES

Size (tons)	Now installed			Plan to buy by end 1981		
	Respondents have	Average/ plant	Projected ind. total	Number of plants	Number of presses	Projected ind. total
Under 20	60	0.9	360	3	3	20
20-40	58	0.9	350	3	4	25
41-80	35	0.5	210	5	5	30
81-100	13	0.2	80	2	2	10
101-200	13	0.2	80	3	3	20
over 200	18	0.3	110	1	2	10
Total	197	3.0	1,200	10	19	120

SINTERING FURNACES

Type	Now installed			Plan to buy by end 1981		
	Respondents have	Average/ plant	Projected ind. total	Number of plants	Number of machines	Projected ind. total
Continuous electric	155	2.3	940	16	20	120
Continuous fuel	71	1.1	430	5	10	60
Batch electric	100	1.5	610	8	19	120
Batch fuel	17	0.3	100	2	2	10
Total	343	5.2	2,100	30	51	310

HEAT TREATING FURNACES

Type	Now installed			Plan to buy by end 1981		
	Respondents have	Average/ plant	Projected ind. total	Number of plants	Number of machines	Projected ind. total
Continuous electric	25	0.4	150	1	1	5
Continuous fuel	13	0.2	80	1	1	5
Batch electric	50	0.8	300	2	2	10
Batch fuel	48	0.7	290	1	1	5
Total	136	2.1	820	5	5	30

ATMOSPHERE GENERATORS

Gas	Now installed			Plan to buy by end 1981		
	Respondents have	Average/ plant	Projected ind. total	Number of plants	Number of machines	Projected ind. total
Hydrogen	60	0.9	360	2	2	10
Dissociated ammonia	47	0.7	280	6	6	35
Endothermic	77	1.2	470	5	6	35
Exothermic	12	0.2	70	2	2	10
Nitrogen	15	0.2	90	8	8	50
Total	211	3.2	1,300	17	24	140

AUXILIARY EQUIPMENT

Type	Now installed			Plan to buy by end 1981		
	Respondents have	Average/ plant	Projected ind. total	Number of plants	Number of machines	Projected ind. total
Powder blenders	119	1.8	720	15	21	130
Impregnating equipment	46	0.7	280	5	5	30

OTHER SUPPLIES

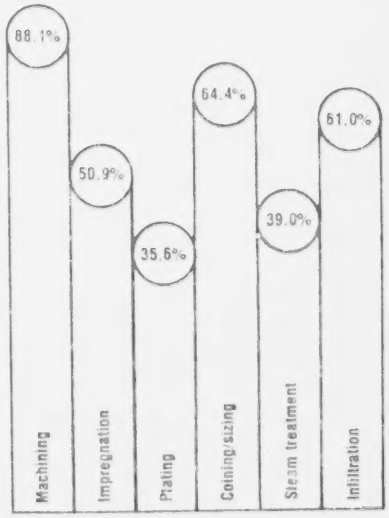
Type	Respondents have	Average/ plant	Projected industry total
Atmosphere	260,043,000 ft³	11,306,217 ft³	4,500,000,000 ft³
Furnace belts	240	3.6	1,500
Sintering trays	19,553	489	120,000

dicate this could change, with a disproportionate number of hydraulic presses being added. Our projection shows 160 hydraulic presses will be installed in 1981. Most mechanical compacting presses are in the under 40 ton range, while most hydraulic units found in our survey have pressing capacities over 200 tons. Perhaps this points to a trend toward larger P/M parts.

The trend in sintering furnaces seems to be toward electric units, both for continuous and batch type furnaces. Our survey indicates that 50 nitrogen sintering atmosphere generators will be added in 1981.

Most of the P/M parts producers surveyed offer secondary operations, with most performing secondary machining and many offering coining/sizing, infiltration and impregnation.

FINISHING SERVICES



ROLL FORMING

Questionnaires were sent to 1011 management and production executives in the roll forming and tubemaking industries. A total of 340 usable responses was received, giving us a response rate of 34%. An industry total of 1500 plants was assumed. Our usable responses therefore represented about 18% of the roll forming and tubemaking industries. Industry totals for installed roll forming and other capital equipment were obtained by expanding our respondents' totals over 1800 plants.

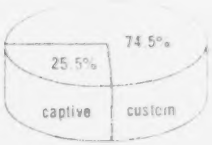
According to our survey, the roll forming and tubemaking industries are very similar in their makeup. Roll forming is 74.5% custom and tubemaking is 74.9% custom. The average roll forming tubemaking plant employs 41.7 people, although the greatest number of plants responding to our survey employ up to 25 people.

Our survey indicates that the roll forming industry plans to buy an additional 1100 roll formers by the end of 1981. Tubemakers plan to buy 250 tube mills in the same period.

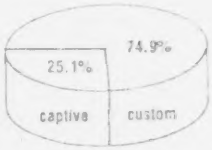
The roll forming process is characterized as being a continuous process, and our respondents indicated that only 21% of incoming material is

CUSTOM OR CAPTIVE?

According to our survey, the roll forming industry is . . .



The tubemaking industry is . . .



GEOGRAPHIC DISTRIBUTION

Top numbers indicate number of roll forming plants in region. Bottom numbers indicate number of roll forming users in region. Based on computer analysis of PRECISION METAL circulation.

ROLL FORMERS & TUBE MILLS

	Now installed			Plan to buy by end 1981		
	Respondents have	Average/ plant	Projected ind. total	Number of plants	Number of machines	Projected ind. total
Roll formers	1079	5.6	10,000	38	118	1,100
Tube mills	203	1.1	1,900	9	27	250

AUXILIARY EQUIPMENT

	Now installed			Plan to buy by end 1981		
Type	Respondents have	Average/ plant	Projected ind. total	Number of plants	Number of machines	Projected ind. total
Coil cars	8	0.0	70	0	0	0
Coil coaters	22	0.1	200	0	0	0
Coil lifters	233	1.2	2,200	8	11	0
Coil tippers	79	0.4	730	2	4	35
Conveyors:						
pre-cut stock	87	0.5	810	3	3	30
Cut-off equipment	842	4.4	7,800	24	59	550
Edge finishers	71	0.4	660	1	1	10
Embossing machines	46	0.2	430	1	1	10
Forming presses	488	2.5	4,500	8	16	150
Job cranes	341	1.8	3,200	7	12	110
Lubricators	322	1.7	3,000	13	39	360
Power shears	250	1.3	2,300	9	15	140
Press brakes	443	2.3	4,100	11	23	210
Punching/ notching presses	1,203	6.4	11,500	14	47	440
Reels uncoilers	1,359	7.0	12,600	22	36	330
Slitters	116	0.6	1,100	2	3	30
Stockers, pre-cut stock	48	0.2	450	0	0	0
Stock straighteners	322	1.7	3,000	12	17	160
Strip accumulators	46	0.2	430	2	3	30
Strip polishers	4	0.0	40	1	4	35
Welders, coil end	203	1.1	1,900	12	18	170
Welders, seam	107	0.6	1,000	2	2	20
Wing formers	21	0.1	200	1	1	10

EXPENDABLE SUPPLIES

Type	Respondents used	Average plant	Projected industry total
Lubricants	304,875 gal	3,350 gal	5,700,000 gal
Coil coating materials	163,350 gal	4,420 gal	3,000,000 gal

SHIPMENTS (1979)

Metal	Respondents shipped (lb)	Projected industry total (lb)
Aluminum	72,166,500	830,000,000
Brass	222,900	2,600,000
Copper	511,800	5,900,000
Laminated strip	4,740,000	55,000,000
Prefinished strip	5,746,000	66,000,000
Prepainted strip	108,409,683	1,200,000,000
Preplated strip	63,712,000	739,000,000
Steel, carbon	620,790,500	7,100,000,000
Steel, galvanized	343,651,101	4,000,000,000
Steel, high-strength low alloy	75,628,074	870,000,000
Steel, stainless	36,875,949	420,000,000
Vinyl clad strip	560,000	64,000,000
Zinc	1,000,000	12,000,000
Other	26,825,743	310,000,000
Total	1,366,840,250	16,000,000,000

SHIPMENT TRENDS

	1980	1981		
Metal		Increase	Decrease	About the same
Aluminum	+ 1.5%	40.8	12.3	46.9
Brass	+ 20.8%	30.0	30.0	40.0
Copper	+ 14.4%	25.0	12.5	62.5
Prefinished strip	– 17.8%	33.3	11.1	55.6
Prepainted strip	+ 8.5%	52.5	10.0	37.5
Preplated strip	– 5.9%	35.7	7.1	57.2
Steel, carbon	– 11.5%	43.5	19.5	37.0
Steel, galvanized	– 7.0%	39.3	18.0	42.7
Steel, high-strength low alloy	– 0.2%	33.3	33.3	33.3
Steel, stainless	– 9.7%	40.0	20.0	40.0
Vinyl clad strip	+ 136.4%	40.0	10.0	50.0
Zinc	+ 20.0%	16.6	16.6	66.8

1980 figures indicate respondents' expected increase or decrease. The 1981 figures represent the percentage of respondents expecting 1981 figures to be greater, smaller or about the same as 1980 shipments.

ROLL SETS

	Respondents used	Average/plant	Projected industry total
Roll forming	513	4.3	6,600
Tubemaking	203	4.7	2,100
Reground rolls	1,327	10.1	18,000

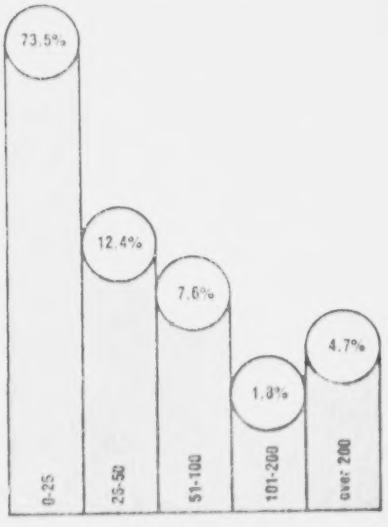
purchased pre-cut. The majority of roll formed material is procured in coil form.

The size of roll forming machines used by respondents to our survey is typically in the 9-12 stand class, with 1-1/2 in. roll shaft diameters and capable of accepting strip up to 15 in. wide.

Auxiliary equipment for roll forming and tubemaking covers a very wide range. Typically, one or two pieces of major types of auxiliary equipment are used per plant. Plans to buy are moderate, with plants showing a substantial interest in cut-off, punching/notching and several other types of equipment.

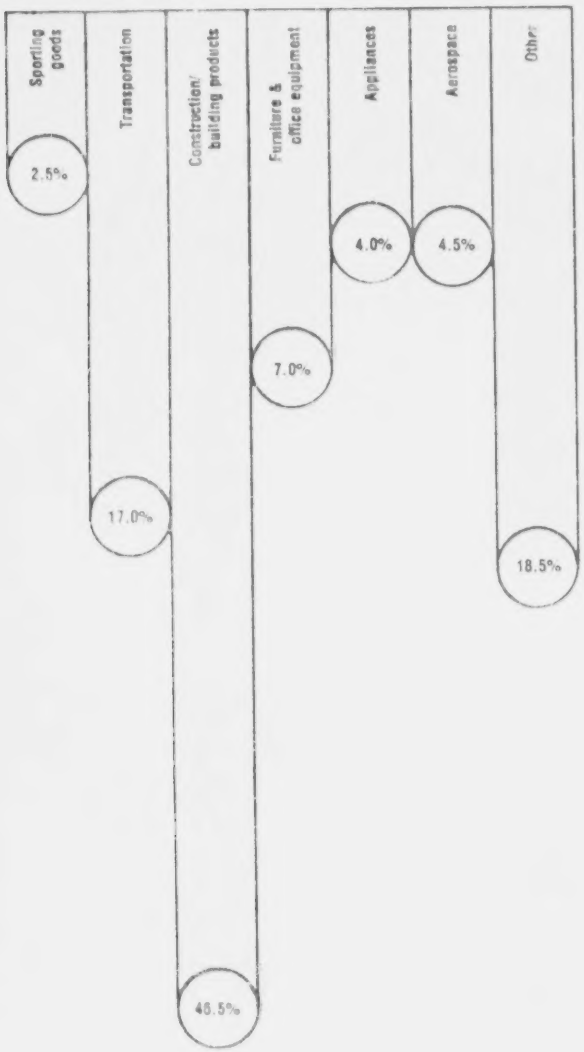
Carbon steel is the most widely roll formed material, but galvanized and various types of prefinished materials are not far behind. While trends in shipments of some metals were down for 1980, many were up, and the roll formers surveyed look to 1981 as a good year with no real surprises.

PLANT SIZE BREAKDOWN BY NUMBER OF EMPLOYEES

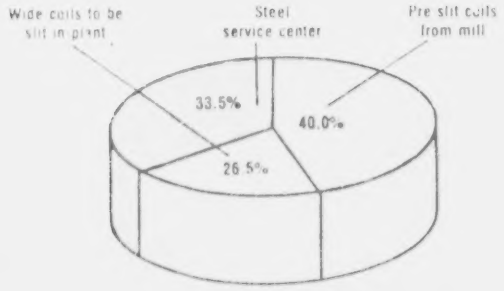


Average employees/plant: 41.7

END-USE MARKETS



SOURCE FOR METALS



ROLL FORMING MACHINE BREAKDOWN

BY NUMBER OF ROLL STANDS

2 - 4	8.0%
5 - 8	21.8%
9 - 12	37.3%
13 - 15	14.1%
16 - 20	15.6%
21 - 25	1.9%
over 25	1.3%

BY ROLL SHAFT DIAMETER

1 in.	7.2%
1-1/2 in.	49.4%
2 in.	23.4%
2-1/2 in.	10.6%
3 in.	4.7%
3-1/2 in.	1.8%
4 in.	2.9%

BY MAXIMUM STRIP WIDTH

2 in. - 6 in.	34.6%
6 in. - 10 in.	18.2%
10 in. - 15 in.	23.9%
15 in. - 20 in.	7.7%
20 in. - 30 in.	6.9%
30 in. - 40 in.	3.5%
40 in. - 50 in.	5.2%

TUBE MILL BREAKDOWN BY MAXIMUM O.D.

1-1/2 in.	28.0%
2-1/2 in.	28.0%
3 in.	20.7%
4 in.	1.6%
5 in.	8.3%
6-5/8 in.	3.6%
over 6-5/8 in.	9.8%